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CENTRAL INTELLIGENCE AGENCY

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1. The development of fighting tanks by the Skoda Works began in 1930, a comparatively late date. The reason for this late start was the general opinion prevailing in Czechoslovakia after World War I that the manufacture of military equipment had little or no future.

2. Although Czechoslovakia had a regular army, the budgetary allowance for the purchase of new equipment was not sufficient to permit the acquisition of complicated machines of war. Prior to 1932, Skoda furnished the Czechoslovak Army with a four-wheel, pneumatic-tired armored car which weighed about eight tons and was driven by a 60-hp. water-cooled in-line engine which permitted a speed of about 80 km./hr. This armored car was known by model numbers PA-I, -II, -III, and -IV. The first three models were armed with machine guns, while the last one carried a 37.2 mm. gun in the turret. The PA-II had a welded armor of rounded shape which was quite expensive to produce. These vehicles had a four-wheel drive and could go in both directions with the same speed, since the steering gear was double and the whole arrangement symmetrical. About 60 were turned out from 1924 to 1930.

3. The first tanks with tracks which the Czechoslovak Army acquired were very light and were designed on the pattern of the British Garden Lloyd. These tanks were not put out by Skoda but by Ceskomoravska Kolben-Danek (CKD), which, as the second largest firm producing machinery, was attempting to break into the armaments field by manufacturing tanks, since guns were the established monopoly of Skoda. These vehicles, which weighed about two tons, had a thin armored case 6 to 8 mm. thick, were open at the top, and resembled the Bren-carrier of World War II. About 80 were ordered in 1931 and 1932, but they did not prove to be very satisfactory because of their tendency to mechanical breakdowns and their limited cross-country capacity, which was due to short construction and a high center of gravity.

4. The next order was for a light tank weighing about 7½ tons with a 37.2 mm. Skoda gun in the turret. CKD delivered about 120 of these vehicles in 1932 and 1933. Once again there were difficulties, largely because the tracks had a tendency to jump off when the tanks were backing up.

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5. Skoda, seeing the commercial success of these tanks and at the same time noting the mechanical difficulties, decided to push its own development of tanks. Various types which were worked out are described in the attached "List of Prototypes" (Table I). The first model to be put into production was an 11-ton tank called the S-IIa or the T-II (also Lt.vz.35, meaning light tank, model 1935). One hundred were ordered from Skoda and the same number from CKD, which was to use Skoda blue prints. The main feature of this model was the tracks and the bogies, which were especially designed to stay in place under the most severe conditions of cross-country driving. However, troubles of a different nature soon developed. The mechanisms for steering and gear-shifting were operated by compressed air, which had the advantage of easy handling but the disadvantage of complicated production and servicing as well as of the danger of freezing in winter because of the condensation of water. The gear shift had a very great range (1:12), but it had the disadvantage of using a sliding dog clutch type of two-speed reduction gear having a speed diffential of about 1:3.2 operated pneumatically. In operation, this became the source of violent checks in the driving elements which caused mechanical breakdowns. After numerous and costly alterations an acceptable compromise was reached and the the order was finally carried out, but no further orders were placed for this type of tank.

6. Profiting from these experiences, CKD developed a new model in 1937 which was successful and was produced in large numbers during World War II. It was called the Lt.vz.38 (designated in German as Lpz 38t, meaning light tank model 1948 Czech). This new tank used a British planetary 5-speed Wilson gear box, which CKD was licensed to produce.

7. After eliminating the most acute difficulties, Skoda succeeded in selling 126 of these 11-ton tanks to Rumania. Afghanistan also placed a small trial order with Skoda for the same model in 1939, but it was never filled because of the imminent German attack on Russia. The ten tanks produced for this order were later sold to Bulgaria. The same country received an additional 15 tanks of this type, which had been seized by the Germans in Rumania and reconditioned by Skoda.

8. During the first years of the war, Skoda turned to more extensive experimentation, concentrating on a 17½-ton tank (see "List of Prototypes", Table I). This development was to some extent in collaboration with the Central Department for Experimentation, Wa Prüf 6 (Waffenprüfungsamt No. 6), under Colonel Olbrich in Berlin. The first prototype of the 17½-ton tank still used compressed air for steering and gear shifting. However, it was improved in such a way that it proved quite satisfactory. The two-speed reduction gear was built into the final drive, where the speed was less. This adjustment, together with a powerful multidisc synchronization, eliminated the shocks. This model had double steering (radii of about 10 meters or turning on place) and curve steering (10 meters) worked mechanically without the use of compressed air. The air valve controller unit at the driver was electrically heated to prevent the moving parts from freezing. The results were quite satisfactory, and after many trial runs, the manufacturing license was sold to Hungary, where the tank was turned out under the name of Turany. About 600 were manufactured during the course of the war by the Manfred-Weis Company, Budapest, Waggonfabrik Györ, and Ganz in Budapest. The price paid for the license was about 6,500,000 Protectorate crowns, 28 Protectorate crowns equaling $1.00.

9. Mechanical steering and shifting of gears was also developed. Compressed air was used to facilitate steering, particularly for blocking one track. The Russian T-34 tank requires over 70 pounds of pressure on one steering lever to accomplish this. With compressed air, it can be done with the touch of a finger.

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It was, however, at length ascertained that in the case of a 17½-ton tank, servo-acting brakes would fill the bill fairly well. Skoda tanks, beginning with the 2-ton model, had a system of track brakes in which the front tension pulls were effected by toothed sprockets meshing with brake drums and brakes.

10. Skoda has a patent for applying the braking action to the front or rear brakes, depending on whether the vehicle is moving forward or backward. In this way, the part of the track in contact with the ground is always under tension and cannot jump off.

11. The use of compressed air for the operation of the brakes made it possible to conduct air to the front or rear brakes with ease. The direction of the air flow was changed simultaneously with shifting into reverse. With the elimination of the compressed air it was necessary to use a different system, which was also patented. In this system, the braking action applies to all four brakes simultaneously; the front brakes are designed for servo action when the tank is moving forward, and the rear brakes for servo action when the tank is moving backwards. This steering arrangement was used in prototype tanks T-13, T-23, and T-15 (see TableI).

12. Considerable improvement was also necessary in the transmission gear. Skoda tanks of this type used a three-speed planetary transmission which was built into the engine fly-wheel. Its total range was about 1:3. To step this up to an over-all range of 1:12 or more, an auxiliary two-stage reduction gear was necessary with a range of at least 1:4. When the gear was shifted from third to fourth speed, two actions had to take place at the same time: the planetary transmission had to be brought from third back to first and the multiplication of the reduction gear had to be changed from 1:4 to 1:1. No driver could perform these two operations manually, but it could be done easily with the use of compressed air. Also, the brake bands and the clutches of the planetary gear change can be easily and simply operated when compressed air is used.

13. The testing department Wa Prüf 6 of the German High Command was not in favor of using compressed air, mainly because personnel did not properly understand its operation, so that servicing was made difficult. Skoda yielded to pressure and worked out several experimental gear shift transmissions, largely of the planetary type. The final form was a five-speed gear box of planetary preselective type. This feature was taken over from the Wilson transmission as manufactured by CKD. With this device it is possible, while the vehicle is running on one gear, to shift the gear lever to the next position and to make the change instantaneously by stepping on the clutch. This system has great advantages for tanks moving over difficult terrain such as mud or sand, since shifting with a slide gear transmission in this case would be impossible. Too much time would be required, and the vehicle would come to a stop before the gears could be shifted.

14. The next problem to be tackled was the compression by some other means than compressed air of the heavy springs used to hold the brake bands and clutches in a locked position when speeds are changed. A special patented servomotor was worked out along the lines of a friction clutch, deriving power from the engine. When the engine stalled with a speed engaged, it could be started up again by putting the reverse lever into neutral. The reversing was done in final drive, where the driving bevel pinion meshed with two ring gears engaged alternately by a dog-clutch. In this way, all speeds could be used forward as well as backward.

15. The brake and gear shift assemblies described above were first used in prototype T-13, a vehicle which was otherwise of little interest. After the value of the new mechanical features had been demonstrated, a larger tank, the T-23, weighing 17½ tons, was built. This experimental vehicle covered over 8,000 km. in good order. A few breakdowns occurred in the transmission (the second gear shift), but it was possible to eliminate them by redesigning a few parts.

16. In 1942 the Germans projected a fast light tank weighing 10½ tons. Skoda was invited to build four prototypes, and a similar order was placed with CKD. Skoda built the T-15 tank along the lines described above, and one of the vehicles underwent a severe road test of some 6500 km. at Kummersdorf near Berlin, the testing ground of Wa Prüf 6. However, before the development of the prototype was completed, the interest of Wa Prüf 6 seemed to have vanished, and the test proved to be of a different nature from what Skoda had expected. Three firms presented experimental vehicles: German MAN, CKD, and Skoda. While MAN and CKD had front drive, the Skoda tank was rear-driven. The Kummersdorf proving ground was sandy, and the tests conducted there were designed to demonstrate that a rear drive will wear out the tracks sooner than a front drive on sandy terrain. The assumption proved correct. There were several breakdowns in the transmission, but they were of the same nature as those in the case of the T-23 and could be eliminated.

17. While experimenting with new types of tanks, the department for the manufacture of military vehicles at the Skoda works was turning out 6-6 trucks for Rumania, and later, between 1941 and 1944, 3-ton half-tracks of Hanomag design, called Hkl-6, were produced for the German Army. In 1942 arrangements were made for working in collaboration with Dr. Porsche, a German engineer and designer who was born in Reichenberg/Liberec, Bohemia, and who had known the Skoda Works for many years. Dr. Porsche had designed the gas-electric transportation system for heavy artillery pieces (305-mm. and 420-mm. mortars) used by the Austro-Hungarian Army in the First World War. He was also the designer of several successful Mercedes racing cars and contributed to the design of the Volkswagen now being manufactured at Fallersleben in the British Zone of Germany. His headquarters were at Stuttgart (Dr. h. c. Ferd. Porsche Konstruktions Gesellschaft G.m.b.H.) during World War II and now seems to be at Gmünd in Carinthia (Austria).

18. When the German High Command decided to introduce the 60-ton Tiger tank, Porsche was invited to collaborate. He advocated a gas-electric drive which for years had given good service in hauling heavy loads. Other tank manufacturers strongly opposed the idea because it would entail an expensive job of construction and extensive use of copper in the gas-electric vehicles. Nevertheless, experimental vehicles, called the Tiger-Ferdinand, were designed, and Skoda cooperated in designing and producing the first experimental number (38). Skoda made only certain assemblies. The conception of the vehicle was not disclosed to Skoda engineers. Later, an improved model, the "180", was introduced. The final development was the "Maus", a supertank of 130 tons, which will be dealt with in a special report.

19. The production of half tracks and of Porsche tank assemblies was finally discontinued in order to concentrate on the production of tank destroyers Pzj.38t, also called G-13. Since samples of this vehicle were turned over to the American Army after the liberation of Pilsen, it is not considered necessary to go deeper into the technical details, which can be seen, in their main points at least, in Table II. The program was initiated in January 1944, but by the end of the year only 300 destroyers had been delivered. In 1945 another 600 were turned out at the average rate of 150 a month.

20. Although this vehicle had certain disadvantages such as low motive power, highly loaded tracks, and unevenly loaded bogies caused by the off-center location of the gun, the tank still represents a powerful defense weapon in

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view of its heavy armor and high-powered gun (V-900, 7.5 cm. caliber). There continued to be considerable interest in it after the war. After long hesitation, largely due to lack of funds, the Czech government ordered 20 new vehicles and had 50 reconditioned which had been left behind in Czechoslovakia by the retreating German Army.

21. The price paid for these vehicles is not known to source, but it is thought to have been low. Czech military authorities pay only for new material, labor, and overhead, since they consider all war material left at Skoda to be a war prize.

22. A more satisfactory deal was concluded with the Swiss Technical Warfare Section (Kriegstechnische Abteilung - KTA) in Berlin, which ordered 8 tank destroyers in 1946 for delivery in December of that year, another 100 in 1947 for delivery between June and December, and another 50 in 1948, for delivery before the end of that year. The price for each vehicle was approximately 53,000 Swiss francs, representing about 50 percent of the actual post-war cost, but since many parts and assemblies were left over from the war, the cost was actually well covered. The Swiss Government will probably not order any more of these vehicles because of the recent political changes in Czechoslovakia.

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CENTRAL INTELLIGENCE AGENCY
TABLE I

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Skoda Designation	Year of Manufacture	Weight in tons	Engine	Trans-mission	Weapons & Armored Case	Remarks
Mu-4 or T-1	1932	2.5	4-cyl.pan-cake, 40hp. air-cooled	Slide gear 6-speed, 3-40km/h, front drive.	1 light MG 6-8 mm. welded	Prototype still at the factory
S-III	1932-1938	18	6-cyl. in-line, 190hp. water-cooled	3-speed epi-cyclic & 2-sp. slide-gear re-duction, 2-25 km/h, rear drive	1 gun 4.7 in turret + 2 MGs, front 30mm sides 22mm, riveted case	2 vehicles deliv. to MNO.
T2-D	1937	5.6	Diesel, 4-cyl. in-line, 55hp. water-cooled	Slide gear, 6-speed, 3-36km/h front drive	1 gun 4.7 in front wall, 1 light MG, front 30mm. sides 16mm. riv. case.	Sold to "SS" in 1940
T-13	1939	14	4-cyl in-line, 130hp. water-cooled	5-speed epi-cyclic, spring & serve operat. 3-32km/h, rear drive	1 gun 3.72 in turret + 2 MGs, front 50mm, sides 25mm., riv. case	Still at the factory
S-IIc or T-21	1938	17.5	8 cyl. V, 240hp, water-cooled	3-speed epi-cyclic & 2-sp., sl.dog-clutch reduc-tion, 3-45km/h, rear drive	1 gun 4.7 in turret . 2 MGs front 35mm. sides 20mm., riv. case	Still at the factory
SP-IIb	1938	17.5	8-cyl. V, 220hp, water-cooled	5-speed epi-cyclic "Wil-son" change gear, 4.5-42 km/h, rear drive	furnished without wea-pons. front 30mm, sides 20mm, riv. case	Engine & transm. from CKD, deliv. to MNO
T-22	1940	17.5	8-cyl.V, 260hp, water-cooled	3-speed epi-cyclic + 2-sp. slide dogclutch reduct 3.5-47km/h, rear drive	furn. with-out weapons front 50mm sides 20mm riv. case.	Built to order of OKH. Still at factory

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TABLE I
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Skoda Designation	Year of Manufacture	Weight in tons	Engine	Trans-mission	Weapons & Armored Case	Remarks
T-23	1940	18	8-cyl.V, 260hp. water-cooled	5-speed epi-cyclic, spring 7 serve-operat. 4-45km/h, rear drive	1 gun 4.7 in turret + 2 MGs front 50mm sides 22mm, riv. case	Still at factory
T-15	1942-1943	10.5	8-cyl.V, 230hp, water-cooled	5-speed epi-cyclic, spring & serve-operat. 5-60km/h, rear drive	1 gun 3.7 (not fur-nished) front 50mm, sides 15mm, welded case	Built to order of OKH, one still at factory

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TABLE II
(a)

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Skoda designation	Customer	Number furnished	Year of production	Weight in tons	Weapons
S-IIa or T-II	MNO (Czechoslovak Ministry of National Defense)	100	1936 - 1937	11	1 gun 37.2mm in turret + 2 Brno MGs
S-IIaR	Rumanian army	126	1937 - 1939	11	"
S-IIa	Bulgarian army	10	1940	11	"
S-II	Yugoslav army	8	1937	6.5	1 gun 37.2mm in front wall, 1 light MG
Tiger-Ferdinand	Nibelungen-Werk, St. Valentin, Ost Mark	38	1942 - 1943	whole vehicle about 60 tons	not furnished
"180"	"	80	1943 - 1944	"	not furnished
"Maus"	"	8	1944	whole vehicle about 130 tons	not furnished
Paj. 38 (t) or G-13	O K H	about 90	1944 - 1945	14	1 gun 75mm [illegible] front wall. 1 MG with AA mounting
Paj. 38 (t) or G-13	Kriegs-Technische Abteilung in Bern, Switzerland	158	1946 - 1948	"	"
Paj. 38 (t) or G-13	M N O	20	1947	"	"

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TABLE II
(b)

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Armored case	Engine	Transmission	Remarks
front plates 25mm. sides 19mm., riveted case.	4-cyl. in-line, gas, 125 hp, water-cooled	3-speed epicyclic + 2-speed slide dog-clutch reduction, 3-35km/h, rear drive	Steering and gear change operated by compressed air
"	"	"	"
"	"	"	"
front plate, 30mm. sides 16mm., riveted case	6-cyl. pancake, gas, 60 hp, air-cooled	6-speed slide gear 3-38km/h, front drive	
not furnished	not furnished	Furnished final drive only, using epicyclic gear reduction	Furnished also; bogies, tracks & tension pulleys
"	"	"	"
"	"	"	"
front plate 60mm. [illegible] 30mm., welded case	6-cyl. in-line, gas, 160 hp., water-cooled	5-speed epicyclic "Wilson", 4,5-38km/h, front drive.	Transmissions, armour cases & guns not made by Skoda. Vehicle designed by CKD.
"	"	"	"
"	"	"	"

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